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The Mediating Role of Parent Expectations on the Relationship Between Depressive Symptoms and Postsecondary Outcomes for Youth with Traumatic Brain Injury

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The Mediating Role of Parent Expectations on the Relationship Between Depressive Symptoms and Postsecondary Outcomes for Youth with Traumatic Brain Injury

by

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"Toutes les grandes personnes ont d'abord été des enfants. (Mais peu d'entre ells s'en souviennet). – Antoine de Saint-Exupéry

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Abstract

The Mediating Role of Parent Expectations on the Relationship Between Depressive Symptoms and Postsecondary Outcomes for Youth with Traumatic Brain Injury

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Annually, around 500,000 youth between the ages of 0-14 years sustain a traumatic brain injury (TBI), a type of head injury that disrupts typical brain functioning. While several neuropsychological effects have been well-documented in the literature, the incidence of depression is elevated in youth with TBI compared to youth without head injuries. The confluence of these neuropsychological and emotional outcomes affect several domains of functioning (e.g., academic, cognitive, familial). That is, not only does TBI affect the individual directly, but it oftentimes affects family members, such that parents struggle to adjust their expectations of their child following a TBI. Taken together, the pursuit of postsecondary education, employment, or autonomy may be compromised for youth with TBI and depression. Yet, high parental expectations are generally regarded as a protective factor for youth with disabilities and in the general population. However, these variables have not been examined amongst youth with TBI. Drawing from data from the National Longitudinal Transition Survey 2 (NLTS-2) and controlling for demographic variables, the purpose of the current study is to

examine the mediating role of parent expectations on the relationship between depressive symptoms and postsecondary outcomes (e.g., academic, life, and employment) for youth with TBI. Results from this study indicated that parent expectations significantly mediated the relationship between depressive symptoms and whether a youth lived independently, a variable that is important for many positive aspects of a youth's well-being and autonomy. In addition, depressive symptoms significantly predicted whether a youth lived independently, as well as their self-beliefs. It is the hope that this study helps parents, clinicians, and teachers understand how to best support youth with TBI as they navigate the complex milieu of postsecondary education, employment, and living.

Table of Contents

List of Tables

List of Figures

Chapter 1: Introduction

Traumatic brain injury (TBI) is a form of an acquired brain injury that affects, annually, approximately 500,000 children in the United States (CDC, 2015; Faul, Xu, Wald, & Coronado). The majority of cases stem from sports/recreation activities and motor vehicle accidents (Langlois, Rutland-Brown, Thomas, 2004). The neurocognitive effects of TBI are variable and concerning, as they depend on several factors (e.g., injury site, age of injury) that influence an already-developing brain. Many youth with TBI experience difficulties with memory, executive functioning, fatigue, and attention, which may negatively affect their academic functioning (Favre, Hughes, Emslie, Stavinoha, Kennard, & Carmody, 2008; Fossati, Ergis, & Allilaire, 2002; Yeates, Luria, Bartowski, Rusin, Martin, & Bigler, 1999).

However, while much of the extant research and treatment planning focuses on the aforementioned neurocognitive deficits, youth with TBI are also at a higher risk than youth without TBI for developing depression, a disorder characterized by a pervasive low mood, sense of worthlessness, and social withdrawal (Kirkcaldy & Siefen, 1998; Kovacs & Goldston, 1991). The negative effects of depression have been comprehensively documented globally and across time; thus, youth with TBI and depression present a significant academic, social, and health concern that warrants awareness, intervention, and education (Durish, Pereverseff, & Yeates, 2018; Jaycox, Stein, Paddock, Miles, Chandra, Meredith, Tanielian, Hickey, and Burnam, 2009; Kirkcaldy & Siefen, 1998; Kovacs & Goldston, 1991).

To better understand depression in youth with TBI, it is important to consider factors that might affect how this disorder manifests. Family is one of the most central systems in a youth's life, yet the occurrence of a TBI oftentimes yields notable distress and sorrow for family members (Groom, Shaw, O'Connor, Howard, & Pickens, 1998; Kreutzer, Gervasio, & Camplair,

1994; Marsh, Kersel, Havill, & Sleigh, 1998; Wallace, Bogner, Corrigan, Clinchor, Mysiw, & Fugate, 1998). Of the various factors that comprise family functioning, parent expectations are the primary area of interest for the current study due to its robustly documented relationship with academic outcomes, and they are often viewed as a protective factor for the effects of depression on academic performance (Aldous, 2006; Bandura, Barbaranelli, Caprara, & Pastorelli, 1996; Cawthon, Garberoglio, Caemmerer, Bond, & Wendel, 2013). Difficulty coping with their child's TBI may affect their expectations, thereby influencing not only their child's present depression and academic functioning, but also their outcomes following high school.

Postsecondary education is stressful for many students, regardless of the education setting and specialty students choose to pursue. Depression has notable effects on one's ability to complete coursework, attend class, or pay attention. These symptoms, coupled with the potential neurocognitive effects of TBI, may make postsecondary education especially challenging for these youth. In fact, enrollment rate at any postsecondary institution for youth with TBI is lower than for students with learning disabilities, with speech/language impairment, who are deaf, with a visual impairment, with an orthopedic impairment, and with other health impairment (US Department of Education). In addition, many youth with TBI reported that they did not receive adequate support during their schooling, which may jeopardize their chances of performing to their highest potential and living independently (Stewart-Scott & Douglas, 2009).

In addition to difficulties with education, depression and TBI have documented, negative effects on one's ability to obtain and maintain employment (Berger, Leven, Pirente, Bouillon, & Neugebauer, 1999; Lerner, Adler, Rogers, Chang, Lapitsky, McLaughlin, & Reed, 2014; Markkula, Kivekas, Suvisaari, Virtanen, Ahola, 2011). In fact, depression is the leading cause of disability worldwide, rendering it a considerable financial burden to society (WHO, 2001). These

difficulties with employment may also make it difficult for youth to develop their autonomy at an age-appropriate level. That is, for postsecondary youth, attending college is likely the first time that they will not reside in the same home as their parents, which encourages youth to make financial, academic, or social decisions on their own. However, without their own income, it is difficult to make independent financial decisions as the money likely comes from their family or other forms of government aid. This suggests that TBI may disrupt a youth's progress towards independent living, requiring them to depend on their parents or be unable to complete tasks for themselves (Faul, Xu, Wald, & Coronado, 2010). While much of extant research has examined students with disabilities within elementary and secondary school settings, postsecondary outcomes are not as widely researched.

The purpose of this study is to examine the extent to which parent expectations mediate the relationship between depressive symptoms and postsecondary outcomes for youth with TBI. Analyses was conducted on the National Longitudinal Transition Study – 2 (NLTS-2) dataset, a nationally stratified random sample of 11,276 students with disabilities who were receiving special education services at the time of data collection. Youth-reported depressive symptoms were examined with parent-reported expectations and postsecondary outcomes. Results from this study may help parents, teachers, clinicians, doctors, and other adults understand how to best support youth with TBI as they navigate the complex milieu of postsecondary education, employment, and life.

Chapter 2: Literature Review

Traumatic Brain Injury

Traumatic brain injury (TBI) is a form of acquired brain injury resulting from trauma to the head that disrupts typical brain function (CDC, 2015). Some leading causes of TBI are sports/recreation activities (e.g., American football), falls, and motor vehicle crashes (Langois, Rutland-Brown, Thomas, 2004). In the United States, approximately 500,000 children aged 0-14 present to the emergency room as a result of TBI per year; youth ages 0-4 were admitted most frequently, followed by youth ages 15-19 (Faul, Xu, Wald, & Coronado, 2010). Determining the severity of a TBI is described as a nebulous construct, and even extant research uses different names to describe a TBI (e.g., minor closed-head injury, concussion) (McCrory, Meeuwisse, Johnston, Dvorak, Aubry, & Molloy, 2009). Current World Health Organization standards describe mild traumatic brain injury as the following:

> "mTBI is an acute brain injury resulting from mechanical energy to the head from external physical forces. Operational criteria for clinical identification include the following: (i) 1 or more of the following: confusion or disorientation, loss of consciousness for 30 minutes or less, post-traumatic amnesia for less than 24 hours, and/or other transient neurological abnormalities such as focal signs, seizure, and intracranial lesion not requiring surgery; (ii) Glasgow Coma Scale score of 13–15 after 30 minutes post-injury or later upon presentation for healthcare" (Carroll, Cassidy, Holm, Kraus, & Coronado, 2004, pp.1).

The Glasgow Coma Scale (GCS) was created to ascertain a person's level of consciousness following a TBI (Teasfale & Jennett, 1974). Domains of functioning include eye opening

response, verbal response, and motor responses. Higher scores indicate more positive functioning. The classifications are as follows:

Coma: No eye opening, no ability to follow commands, no word verbalizations (GCS score of 3-8)

Severe Head Injury: GCS score of 8 or less

Moderate Head Injury: GCS score of 9 to 12

Mild Head Injury: GCS score of 13 to 15.

Fortunately, the majority of youth hospitalized sustain mild TBI (Yeates, 2010). However, despite the injury being labeled as mild, youth with this severity of TBI are still at-risk for developing acute or chronic neurocognitive effects following their TBI (US Department of Health and Human Services, 1998).

Neurocognitive Effects of TBI

The neurocognitive effects of TBI are highly variable and especially concerning for youth since their brains develop into early adulthood. As such, amongst youth, TBIs are considered a chronic disease process rather than a single event, as sequelae from TBI may change over time as the youth's brain continues developing (DePompei & Tyler, 2004; Masel & DeWitt, 2010). While the effects of TBI vary depending on several factors (e.g., site/extent of injury, age of injury), some possible long-term effects include, but are not limited to: difficulties with attention, memory, processing speed, and executive functioning, as well as headaches and increased fatigue (Yeates, Luria, Bartowski, Rusin, Martin, & Bigler, 1999). While symptoms may be most pronounced immediately or shortly after an injury and resolve over time, some children with TBI may experience long-term, persistent symptoms (Barlow, Crawford, Stevenson, Sandhu, Belanger, & Dewey, 2010; Nacajauskaite, Endziniene, Jureniene, & Schrader, 2006). In fact, one

study found that 13.7% of school-aged children with mild TBI were still symptomatic three months after the initial injury (Barlow et al., 2010). Several individual and familial factors, such as cognitive ability and behavior before the injury, may predict whether a youth with a TBI is at-risk for more chronic neurocognitive effects. A model for neurocognitive effects following a mild TBI can be found below:

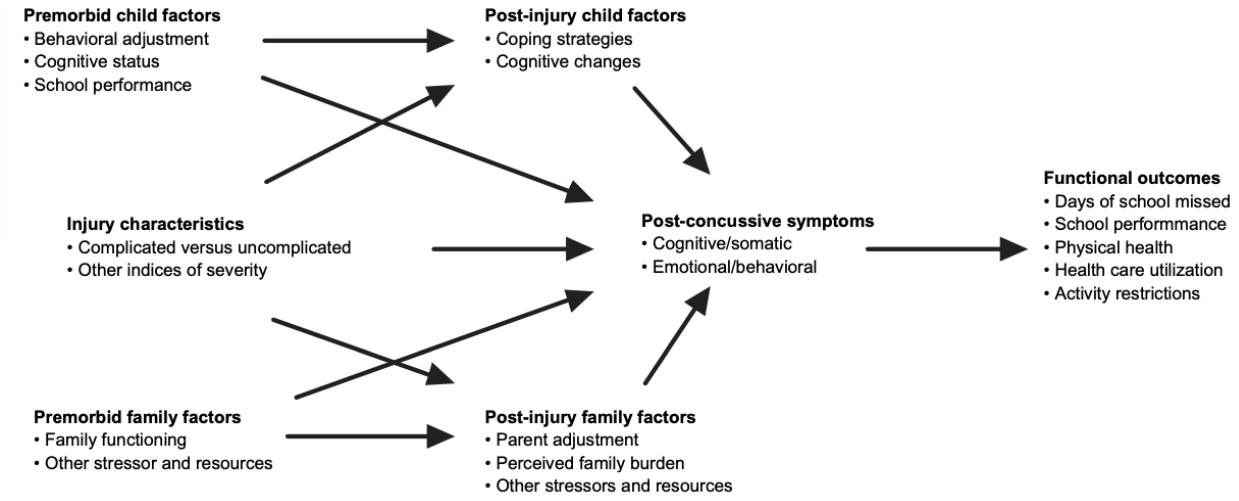

Figure 1. Model for study of neurocognitive effects for youth following a TBI (Yeates & Taylor, 2005, pp. 8).

TBI and Academic Functioning

As noted earlier, there are several pre- and post-injury factors that affect functional outcomes. Most notable is that two out of five functional outcomes are related to school: days of school missed and school performance. That is, the occurrence of a TBI may compromise the youth's academic functioning (Taylor, Swartwout, Yeates, Walz, Stancin, & Wade, 2008). For example, they may struggle to (a) focus in class, (b) shift their attention, (c) plan their approach to problem solving, (d) complete homework or exams in a timely manner, or (e) remember relevant information (Favre, Hughes, Emslie, Stavinoha, Kennard, & Carmody, 2008; Fossati, Ergis, & Allilaire, 2002).

For receipt of school services, TBI is an eligibility category in the Individuals with Disabilities Education Act (IDEA). The full statute is below:

"Traumatic brain injury means an acquired injury to the brain caused by an external physical force, resulting in total or partial functional disability or psychosocial impairment, or both, that adversely affects a child's educational performance. Traumatic brain injury applies to open or closed head injuries resulting in impairments in one or more areas, such as cognition; language; memory; attention; reasoning; abstract thinking; judgment; problem-solving; sensory, perceptual, and motor abilities; psychosocial behavior; physical functions; information processing; and speech. Traumatic brain injury does not apply to brain injuries that are congenital or degenerative, or to brain injuries induced by birth trauma" (Section 300.8).

This designation suggests that, the neurocognitive effects of TBI are an area of academic concern to the extent that it mandates federal intervention. Students who qualify for special education services under the TBI eligibility receive services through an Individualized Education Plan (IEP) that is created collaboratively with the youth's parents, teachers, and administrators. Services may include accommodations (e.g., extra time on class work or tests, preferential seating towards the front of the classroom) or intervention (e.g., pull-out services for reading). However, a qualitative study indicates that while teachers of youth with TBI are sympathetic and try to be helpful, the teachers lack training to meet the academic needs of these youth (Todis & Glang, 2008). It is important to note that a youth's educational and emotional needs are likely to be different from prior to the injury upon their return to school. Adjusting to these changes may be distressing, especially since more demands are placed on the child, at home and at school, as they age.

Depression, Academic Functioning, and TBI

While the aforementioned neurocognitive effects of TBI may yield difficulties within academic settings, youth are also at-risk for emotional disorders that can affect academic functioning, such as depressive disorders, after a TBI. According to the Diagnostic and Statistical Manual of Mental Disorders – 5th Edition, depressive disorders include major depressive disorder, disruptive mood dysregulation disorder, premenstrual dysphoric disorder, persistent depressive disorder (i.e., dysthymia), depressive disorder due to another medical condition, other specified depressive disorder, and unspecified depressive disorder (American Psychiatric Association, 2013). The overarching criteria for diagnosis shared by these disorders is the presence of a sad, empty mood that significantly affects an individual's functioning. These disorders differ in their presumed etiology, timing, and duration (American Psychiatric Association, 2013).

The presence of a depressive disorder, as well as its negative effects on academic, social, and familial functioning, has been researched and documented globally and across time (e.g., Frojd, Nissinen, Pelkonen, Marttunen, Koivisto, and Kaltiala-Heino, 2008; Haines, Norris, & Kashy, 1996; Hembree, 1988; Hishinuma, McArdle, & Chang, 2012; Jaycox, Stein, Paddock, Miles, Chandra, Meredith, Tanielian, Hickey, and Burnam, 2009; Roeser, Eccles, & Sameroff, 2000; Speilberger, 2006). Regarding depressive disorders among youth, associated symptoms including difficulty concentrating, social withdrawal, sense of worthlessness, and low self-esteem may decrease motivation to learn and produce negative outcomes related to continuing education and employment (Kirkcaldy & Siefen, 1998; Kovacs & Goldston, 1991). Nowadays, academic performance is most often measured by a student's grade point average (GPA) (Froid et al., 2008; Kovacs & Goldston, 1991; Reinharz, Frost, & Pakiz, 1991). Major depressive

disorder has been associated with poor school performance even after symptoms diminish, though one of the more notable findings is that self-reported depression is associated with lower academic performance (i.e., decreased GPAs) (Reinherz, Giaconia, Pakiz, Silverman, Frost, & Lefkowitz, 1993; Shahar, Henrich, Winokur, Blatt, Kuperminc, & Leadbeater, 2006).

Amongst youth without head injuries, the rate of unipolar depression is approximately 1-2% for pre-pubertal children, and approximately 4-5% for adolescents (Costello, Egger, & Agnold, 2005; Egger & Agnold, 2006; Emery, Barlow, Brooks, Max, Villavicencio-Requis, Gnanakumar, & Yeates, 2006; Thapar, Collishaw, Pine, & Thapar, 2012; Trenchard, Rusy, & Bunton, 2013). In contrast, approximately 33-52% of youth with TBI are diagnosed with depression one year following their injury, even when they did not have a diagnosis pre-injury (Bockting, Hollon, Jarrett, Kuyken, & Dobson, 2008; Fann et al., 2003). After seven years, the risk of depression is 61% (Hibbard et al., 1998). Thus, with the aforementioned difficulties following TBI, coupled with the effects of depressive on several life domains, youth with TBI and depression present a significant health and academic concern (Durish, Pereverseff, & Yeates, 2018).

TBI and Family Functioning

While much of the extant research understandably focuses on the individual directly affected by a TBI, there is a recent push in the past decade to document and understand parents' experiences following a youth's TBI. Many findings suggest family functioning is negatively affected by TBI, regardless of the severity of the initial injury (Ganesalingam, Yeates, Ginn, Taylor, Dietrich, & Nuss, 2008; Roscigno & Swanson, 2011). In a study that utilized two semi-structured interviews to examine parents' experiences following their child's TBI, one of the main qualitative themes that emerged was the notion of grieving for the child the parents knew

before the head-injury (Roscingo & Swanson, 2011). In other words, parents or caregivers oftentimes experience debilitating distress when their child experiences a TBI. In fact, clinically elevated levels of distress, depression, and anxiety have been indicated amongst 30-50% of adults caring for a youth with TBI one year after injury (Sander & Kreutzer, 1999). When compared to families without a person with an injury or families of medical patients, families with a member who sustained a TBI showed clinically significant levels of dysfunction (Kreutzer, Gervasio, & Camplair, 1994).

While many studies have examined the relationship between several variables (e.g., severity of injury, time since injury, neuropsychological functioning) and family functioning following a TBI, one of the more consistent findings in the literature is that personality and behavioral changes have the most severe and long-lasting effects on parental distress (Groom, Shaw, O'Connor, Howard, & Pickens, 1998; Kreutzer, Gervasio, & Camplair, 1994; Marsh, Kersel, Havill, & Sleigh, 1998; Wallace, Bogner, Corrigan, Clinchor, Mysiw, & Fugate, 1998). Many parents may have difficulty adjusting expectations of their child following a TBI. In a qualitative study that examined parents' experiences five years post-TBI, four main themes emerged: a) grateful to still have my child, b) grieving for the child I knew, c) running on nerves, and d) grappling to get what my child and family need (Roscigno & Swanson, 2011, pp. 1423). Within the second theme (grieving for the child I knew), parents reported sadness about both the initial injury and that the changes they were witnessing in the child were likely permanent (2011). As such, adjusting expectations for their child's recovery was necessary, though provided an additional area of distress and sorrow (2011).

It is important to note, however, that family functioning and parental distress prior to the injury is a more robust predictor of family functioning one year after the TBI than injury

severity. In addition, youth with more cohesive, supportive, and less stressful family environments pre-injury have fewer behavior problems and better academic outcomes at one year than youth living with a poorly functioning, rigid, and stressed family pre-injury (Rivara, Fay, Jaffe, Polissar, Shurtlcff, & Martin, 1992; Rivara, Jaffe, Fay, 1993).

Depression, TBI, and Parental Expectations

Given the negative effects of depression across several life domains, protective factors such as positive parental relationships may reduce the severity of negative outcomes amongst youth affected by depression. Several studies have documented the relationships between high depression and high levels of parental rejection, low levels of parental warmth, and high levels of parental control (Crook, Raskin, & Eliot, 1981; Rapee, 1997). Of the various factors that comprise parental relationships (such as the aforementioned qualities), parental expectations are the primary area of interest for the current study due to its robustly documented relationship with academic outcomes. Parental expectations, for the purposes of this study, is constructed broadly of main goals for their child such as obtaining gainful employment, living independently, or completing postsecondary education (Cawthon, Garberoglio, Caemmerer, Bond, & Wendel, 2013). Several research studies indicate that higher parental expectations are associated with a youth's more positive academic expectations or academic functioning; for example, research indicates these youth receive higher grades and remain enrolled in school longer (e.g., less attrition) than youth whose parents hold low expectations (Aldous, 2006; Bandura, Barbaranelli, Caprara, & Pastorelli, 1996; Davis-Kean, 2005; Pearce, 2006). In addition, high parental expectations are linked with student motivation to achieve in school or attend college (Hossler & Stage, 1992).

As noted earlier, positive parental expectations are viewed as a protective factor for the effects of depression on academic performance. While positive parental expectations are linked with higher academic performance, a negative shift in parental expectations due to an adventitious event may decrease youth's academic functioning. The sudden nature of TBI and its associated effects may dramatically affect how a parent perceives their child's abilities; that is, parents now need to interpret their child's abilities within the context of this trauma. Yet, parents may lack information about the neurocognitive effects of TBI or struggle to understand the underlying biological factors that increase or decrease risk. As such, at a systems level, parent expectations is contingent on their amount of knowledge about TBI and its associated effects. Holding unrealistic expectations of their child may increase symptoms of unworthiness and exacerbate other symptoms of depression, placing their child at-risk for poor outcomes in several life domains, especially as the youth transitions into postsecondary settings.

Postsecondary Outcomes

Depression and Postsecondary Education

Postsecondary education is typically defined as any education beyond high school, which includes two-year colleges, four-year-colleges, vocational training, or trade school. Postsecondary education is also stressful for many students, regardless of the type of education they pursue. According to the American College Health Association, 39% of college students reported such a high level of depression that they noted it was difficult to function (Reilly 2018). Feelings of hopelessness, sadness, and decreased motivation are linked to an elevated risk of dropping out from postsecondary education (Hysenbegasi, Hass, & Rowland, 2005). Depression may also lead to suicide, which is the second-learning cause of death amongst postsecondary students (Floyd, Mimms, & Yelding, 2007). Taken together, the effects of depression on

academic functioning, especially within postsecondary settings where individuals often need to make a number of stressful future, financial, or personal decisions, continues to be an area of concern for institutions, families, and individuals around the globe.

TBI and Postsecondary Education

According to the US Department of Education, 61% of young adults in the TBI disability category enrolled in any kind of postsecondary education (US Department of Education. More narrowly, 42% enrolled in a two-year or community college, 37% enrolled in a vocational, business or technical school, and 17% enrolled in a four-year college (U.S. Department of Education). Enrollment rate at any postsecondary institution for youth with TBI is lower than for students with learning disabilities, with speech/language impairment, who are deaf, with a visual impairment, with an orthopedic impairment, and with other health impairment (US Department of Education). It is also concerning that, while the rates of enrollment are low, not all who attend postsecondary settings receive appropriate support.

Approximately 70% of youth with TBI enrolled in postsecondary institutions reported that they received help with schoolwork, though only 34% reported that they had ever received accommodations or supports from the school (US Department of Education). This suggests that a majority of youth with TBI are not receiving services they need in postsecondary settings. Students reported several changes following their return to school after a TBI, such as reduced course load, altered educational goals, and increased need to use study skills (Stewart-Scott & Douglas, 2009). Certainly, shifting educational goals and the need to improve study skills are common areas that all students develop throughout their education. For youth with TBI, the sudden acquisition of and adjustment to the injury may interfere with educational goals and the pursuit of a postsecondary education.

In a qualitative study of postsecondary transition outcomes for youth with TBI, results indicated that youth with early, severe TBI were often placed into Life Skills programs and graduated with modified diplomas, but were not qualified to enroll in postsecondary settings (Todis & Glang, 2008). However, those who were injured in high school, and had planned to go to college prior to their injury, did enroll, though found it to be quite challenging (2008). This suggests that the student's and parents' pre-injury attitude towards college may affect a student's motivation to attend a postsecondary institution. However, with the potential for parent expectations to shift following an injury, youth with TBI may feel unprepared to pursue postsecondary education. This puts youth with TBI at an academic and economic disadvantage, as those working full-time with a bachelor's degree earns twice as much as someone with a high school diploma over a 40-year period (US Census Bureau, 2012). As noted earlier, youth with TBI are also at risk for depression, which in and of itself interferes with many peoples' ability to work on a day-to-day basis.

Depression and Employment

According to the World Health Organization, depression is the leading cause of disability worldwide (WHO, 2001). In the schools, workplace, and other settings, depression considerably affects attendance, productivity, and engagement (McTernan, Dollard, & LaMontagne, 2013). Even when at work, depressed individuals may not function as optimally due to fatigue, difficulty concentrating, or moving slowly (Markkula, Kivekas, Suvisaari, Virtanen, Ahola, 2011). As such, depressed workers were found to have four times the amount of work limitations than non-depressed colleagues (Lerner, Adler, Rogers, Chang, Lapitsky, McLaughlin, & Reed, 2014). At times, severely depressed individuals are unable to show up to work. In fact, likely due to little energy and poor self-concepts, depressed individuals take two to three times more short-

term work-disability days than those without depression (Kessler et al., 1999). While employment is certainly attainable for depressed individuals, findings from Canada indicate that the level of unemployment amongst depressed individuals is double to triple what it is compared to provincial data (Rizvi, Cyriac, Grima, Tan, Lin, Gallaugher, McIntyre, & Kennedy, 2015). This may be because depressed individuals have difficulty maintaining employment or consistently working at their highest ability. Taken together, depression is a tremendous cause for concern within the employment sector, given its prevalence as well as the financial costs of lost productivity.

TBI and Employment

In addition to the economic benefits, employment for the general population yields several psychological benefits, namely a positive quality of life, increased independence, and satisfaction with life. For individuals with TBI, the ability to engage in such activities is a strong predictor of a positive quality of life and satisfaction (Berger, Leven, Pirente, Bouillon, & Neugebauer, 1999). Higher socioeconomic status, injury severity, and receipt of rehabilitation services were significantly associated with employment (Todis, Glang, Bullis, Ettel, & Hood, 2011). Amongst individuals receiving inpatient rehabilitative care, the employment rate of individuals with TBI was 61%, which decreased to 28% after a one-year follow-up (National Data and Statistical Center, 2015). Many individuals with TBI may not return to work due to associated functional impairments, yet participation in vocational programs oftentimes signifies recovery amongst those with TBI (Levack, McPherson, & McNaughton, 2004).

Several findings regarding employment outcomes of youth with TBI have come from secondary analyses of the National Longitudinal Transition Study – 2 (NLTS-2). Before discussing such findings, it is important to understand the purpose and process of NLTS-2.

Collected in two stages, NLTS-2 used a stratified random sample of approximately 3,600 Local Education Agencies (LEA) that serve youth with special education needs. In total, 501 LEAs and 38 special schools agreed to participate in the study, which involved provision of student rosters, from which the student sample was selected. Students were stratified by disability category and then randomly selected from each disability category, totaling to 11,276 students enrolled in the study, which lasted ten years. One of the sample design goals was for sampling to be generalizable to all students with disabilities, as well as within each category (NLTS-2). According to NLTS-2, young adults with TBI who received special education services in high school are employed at lower rates than the general population. However, students with TBI who had transition goals were more likely than youth with TBI without transition goals to be employed (Wehman, Chen, West, & Cifu, 2014). This suggests that having appropriate supports implemented during high school is associated with positive outcomes following graduation. That is, youth whose special education services are not as direct, intensive, and goal-directed are at-risk for poor post-school outcomes. However, in a longitudinal study that investigated the post-high school transition experiences of youth with TBI, a maximum of 44% of youth with TBI were employed at any time, suggesting that youth with TBI experience fluctuations in employment following high school (i.e., it is difficult for these youth to maintain consistent employment).

TBI, Parent Expectations, and Autonomy

As a construct, autonomy is multifaceted and traditionally includes definitions such as freedom to make choices, pursue one's goals, or control one's behavior without influence from others (Dubas & Petersen, 1996; Wehmeyer, 2000). Developmentally, the transition from adolescence to adulthood is the time in which adolescents gain autonomy from parents and create

their own identities. For postsecondary youth, attending college is likely the first time that they will not reside in the same home as their parents. Parents therefore intervene in their lives less frequently, and youth are encouraged to begin making financial, academic, or social decisions on their own.

Extant research indicates that parent expectations of youth's autonomy predicts a youth's actual levels of autonomy (Fan & Williams, 2010; Lease & Dahlbeck, 2009). As such, if a parent has low expectations for their child to behave autonomously, the youth will also have low expectations of their autonomy. Similar to obtaining postsecondary education and employment, the ability to live independently has well-documented, positive effects on individuals' quality of life, especially so for those with disabilities. According to Frieden et al., 1979, independent living includes the following: 1) fulfilling social roles, 2) having control over one's life, 3) and having little dependence on others for completing daily routines, tasks, or activities.

Yet, for individuals who experience TBI, their ability to live independently may be compromised. Amongst adults living in community dwellings, approximately 80% require some form of assistance with daily activities, such as cleaning the house, cooking, or completing tasks (Dawson & Chipman, 1995). This is especially concerning because individuals who sustain these injuries are generally quite young, as noted earlier (Faul, Xu, Wald, & Coronado, 2010). This suggests that TBI may disrupt a youth's progress towards independent living, requiring them to depend on their parents or be unable to complete tasks for themselves. In addition, it may be difficult for them to maintain employment or return to school due to functional impairments following a TBI, rendering it difficult for these youth to earn money, complete their education, and increase their independence.

Statement of the Problem

While much of extant research has examined students with disabilities within elementary and secondary school settings, postsecondary outcomes are not as widely researched. This is concerning, as individuals in postsecondary settings typically develop skills to live and function independently within society, and TBI may disrupt an individual's progress towards independence. In addition to neurocognitive sequalae that may manifest following a TBI, emotional difficulties, namely depression, have also been documented in extant research. Separately, the presence of depression or TBI oftentimes affects academic, social, and family functioning. When coupled, youth are especially at risk for negative outcomes in the short- and long-term without appropriate services and expectations. While previous research has yielded separate links between depression or parent expectations on postsecondary outcomes, the relationship between these variables for a highly heterogeneous population, youth with TBI, has not yet been examined.

Statement of Purpose

The purpose of this study is to examine the extent to which parental expectations mediate the relationship between depressive symptoms and postsecondary outcomes for youth with TBI. I hypothesize that parental expectations will significantly mediate the relationship between depressive symptoms and postsecondary outcomes for youth with TBI. Results from this study may help parents, teachers, and other proximal figures understand how to best support youth with TBI as they navigate the complex milieu of postsecondary education, employment, and life.

Chapter 3: Method

Research Questions

Research Question 1: To what extent do depressive symptoms predict academic, life, and employment postsecondary outcomes for youth with traumatic brain injury?

Analysis: Linear regression; Postsecondary outcomes will be regressed on depressive symptoms and the covariates for all six outcomes of interest.

Research Question 2. To what extent do depressive symptoms predict parent expectations for youth with traumatic brain injury?

Analysis: Linear regression; Parental expectations will be regressed on depressive symptoms and the covariates for all six outcomes of interest.

Research Question 3: To what extent do parent expectations mediate the relationship between depressive symptoms and academic, life, and employment postsecondary outcomes?

Analysis: Postsecondary outcomes will be regressed on depressive symptoms, parent expectations, and the covariates for all six outcomes of interest.

Dataset

This study employed data from the National Longitudinal Transition Study (NLTS2), a large-scale, federally commissioned dataset that collected information about students with disabilities in the United States (Newman et al, 2001). The U.S. Office of Special Education Programs (OSEP) commissioned NLTS2 to investigate the characteristics, experiences, and achievements of students with disabilities as they transitioned from high school to adult life. These students were aged 13-16 as of December 2000, and data was collected over a period of 10 years. Information about more than 11,000 students with disabilities was included in this dataset, of which more than 400 were identified as having a TBI. It is important to keep in mind that,

throughout the document, all numbers have been rounded to the nearest tens place in accordance with IES policy.

Sampling

The NLTS2 sample was developed in two stages. A stratified random sample of over 3,500 local education agencies (LEAs) who serve students receiving special education services from grades 7-12 were selected. These LEAs, along with 80 state-supported special schools that serve students primarily with hearing and vision difficulties as well as multiple disabilities were invited to participate. 500 LEAs and 40 special schools agreed to participate. The rosters of students who were receiving special education was stratified by disability category, and then students were randomly selected from each category (Newman et al., 2001). An analysis of the region, wealth, and size of the LEA sample indicated that the sample was representative of the LEA population (Javitz & Wagner, 2003). 1,250 students per disability category were sampled, except for youth with TBI or deaf-blindness. All students with TBI or deaf-blindness were selected for study participation due to lower incidence compared to the other disability categories. Data was collected from schools, students, and parents from 2001 to 2009.

Study Variables

Covariates (e.g., family social-economic status (SES), age of insult, ethnicity, and gender) were drawn from the first wave of NLTS2.

Income. Extant literature demonstrates that higher SES predicts higher parent expectations (Raty & Kasanen, 2010). This was likely due to the variable of parent education, as greater education oftentimes predicts higher salaries. As such, the current study controlled for income in order to most accurately estimate the effects of parent expectations and thus the postsecondary outcomes.

Age of Injury. Numerous studies have documented that cognitive and academic development, as well as a full recovery from TBI, are more likely to be compromised in infancy/early childhood (age 7 or below) than compared to middle childhood/adolescent (Dennis, Wilkinson, Koski, & Humphreys, 1995; Ewing-Cobbs, Fletcher, Levin, Francis, Davidson, & Miner, 1997; Levin, Ewing-Cobbs, & Eisenberg, 1995; Oddy, 1993). The current study controlled for age of injury in order to most accurately estimate the postsecondary outcomes for youth with TBI.

Gender. According to existing research, gender differences in the incidence of TBI are quite established, with about twice as many males suffering from TBI than women (Kraus & Nourjah, 1988). This is likely due to relatively higher participation in contact sports, such as American football. As such, the current study controlled for gender in order to most accurately estimate the postsecondary outcomes for youth with TBI.

Independent Variable

The independent variable (depressive symptoms) was collected from Waves 2 through 5 of NLTS-2, though data from Wave 2 was used for the purposes of this study. Five statements about depressive symptoms were asked to the youth on a self-report form, and the student was asked to rate their level of agreement with the statement in a Likert scale from 1 to 4. Questions include (with statements in *italics)*: "In the past week, how often did you feel you *enjoyed life?"* or "In the past week, how often did you feel *people disliked you?*" Scores were reverse coded as necessary, then summated. An average was reported as the score used for analysis. For more details on the depressive symptoms variable, see Appendix A.

Mediating Variable

The mediating variable, parent expectations, was also analyzed. This data was collected in Waves 2-5, but data from Wave 2 (two years after Wave 1) will be used for the purposes of this study as the sample size decreased notably when examining data from Waves 3 and 4 due to attrition or participants not meeting inclusion criteria. Out of seven variables, six examined the likelihood that the student will complete high school, attend postsecondary school, complete a technical or vocational program, graduate from a two-year or community college, graduate from a four-year college, and live away from home without supervision. The seventh variable was the sum of two Likert scale questions asking about the likelihood a student would obtain paid employment and be able to live independently without financial support from parents. For more information about this variable, please see Appendix B.

Dependent Variables

The dependent variable, postsecondary outcomes, was categorized into three groups: Employment Outcomes, Academic Outcomes, and General Life Outcomes. These data were collected during Wave 5, eight years after Wave 1. For General Life Outcomes, two outcomes will be provided. The first outcome will be a question coded as "1" if a young adult had lived independently or semi-independently (e.g., dorm). A self-beliefs scale was also examined, which consisted of five Likert scale items. For more details on the self-beliefs variable, see Appendix C. Regarding employment, there were three total outcomes. For the first, students were asked if they had ever worked for pay outside of the home (coded as "1" if yes). The second outcome was a job satisfaction scale, which asked questions about satisfaction with income, social aspects of the job, or career advancement potential. For more details on the job satisfaction variable, see Appendix D. The third outcome inquired about the student's hourly compensation if they were

presently employed. For Academic Outcomes, there was one outcome – whether students had graduated from postsecondary education. See Table 1 for clarification of variables and when they were collected.

Table 1
Study Variables

Variables	*Type of Variable*	*When Collected*
Covariates		
Gender	Categorical	Wave 1 (2001)
Family Income	Categorical	Wave 1 (2001)
Ethnicity	Categorical	Wave 1 (2001)
Age of Injury	Continuous	Wave 1 (2001)
Independent Variable		
Depressive Symptoms	Continuous	Wave 2 (2003)
Mediator Variable		
Parent Expectations	Continuous	Wave 2 (2003)
Dependent Variables		
Graduated Postsecondary Institution	Binary	Wave 5 (2009)
Ever Employed	Binary	Wave 5 (2009)
Wages	Continuous	Wave 5 (2009)
Job Satisfaction	Continuous	Wave 5 (2009)
Lived Independently	Binary	Wave 5 (2009)
Self-Beliefs	Continuous	Wave 5 (2009)

Inclusion Criteria

For the purposes of this study, the student had to have sustained a TBI and be receiving special education services under this eligibility. This data was collected from parents during the first wave of data collection. Youth were excluded if information regarding their postsecondary outcomes on any particular variable was missing, as multiple imputation is not appropriate if there is missing data on the dependent variables (Alisson, 2001).

Participants

As noted above, all youth with TBI were selected for study participation in the original NLTS-2 dataset due to low incidence compared to the other eligibility categories (450 participants compared to 1,250 participants). Please see Appendix E for a more detailed table of the demographics for all participants in the original sample.

For the purposes of this present study, and given the previous exclusion criteria, the number of participants per outcome reduced notably. Briefly, the number of participants in each outcome ranged from 40 to 60 (rounded per IES policy). All participants were between the ages of 14 and 16. The average age of injury ranged from 5.92 to 6.73 years. The majority of participants were identified as male and White. Please see Appendices F-J for more detailed information about each outcome and its covariates. This data was collected during Wave 1.

Procedure

Data preparation. All data preparation was performed using *R.* IES approved the author as a user, therefore granting permission for access to the data. Data was accessed by contacting an IES-approved systems administrator and downloading it from a password-protected drive. The data was then stored on a password-protected, US-government approved computer in a locked room. All coding used for data preparation can be found in Appendix K.

After the data was made available for preparation, the first step was to create a subset of data that contained only youth with TBI. After opening the Wave 1 dataset of NLTS-2, the participants who did not have a TBI as a special education eligibility were removed from the data. Then, a subset of this data was created that kept only the covariates of interest (Age of Injury, Gender, Ethnicity, Family Income) for this study. All other columns were deleted with

the exception of the youth's ID number that was used for merging data from other waves with the correct participant.

For the depressive symptoms variable, Wave 2 of NLTS-2 was opened. The columns that contained the depressive symptoms items and the youth's ID number were kept; all other columns were removed from analysis. The same procedure took place for parent expectations; Wave 2 data was opened, and items related to parent expectations as well as the participant ID number were extracted from this dataset. Then, this data with the depressive symptoms was merged with the aforementioned dataset with participant demographics by ID number. A sum of the parent expectations items and an average of the depressive symptoms items were calculated and inserted into their own column.

For the dependent variables, all relevant column(s) (depending on if the variable was binary or continuous) were extracted from Wave 5 data. The data from each outcome was then merged into the dataset described above that contained the covariates, depressive symptoms, and parent expectations, for a total of six datasets (one for each outcome). The survey weight from NLTS-2 (Wave 5 Any Parent/Youth Report survey weight since data came from both parent and youth) was then merged into each dataset.

Preliminary analyses. Descriptive statistics (e.g., means, standard deviations, range) were calculated for each variable. Results of a power analysis indicated that to detect a moderate effect size of $f^2 = 0.5$ with power of 0.80 at an alpha-level of 0.01, a total of 24 participants was necessary per outcome (Faul, Erdfelder, Buchner, & Lang, 2009).

Missing data and multiple imputation. The use of multiple imputation or non-response weighting adjustments is most appropriate when data is missing completely at random (MCAR) or at random (MAR). Briefly, MCAR means that missing observations are a random subset of all

observations, such that observed and missing data will have similar distributions. MAR means that while there may be differences between missing and observed variables, these differences could be explained by other observed variables. (Bhaskaran & Smeeth, 2014). The weighting variable from Wave 5 was used, as Wave 5 had the largest proportion of missing data compared to Waves 1 and 2. Please see Table 2 for more information about missing variables.

Table 2
Missing Data Percentages

Variable	*Percentage Missing*
Depressive Symptoms	
Enjoyed Life	<10
Depressed	<10
Liked by Others	<10
Hopeful of Future	<10
Lonely	<10
Parental Expectations	
Complete High School	<10
Attend Postsecondary	20
Complete Vocational	20
Graduate Two-Year College	20
Graduate Four-Year College	20
Youth Will Get Driver's License	<10
Youth Will Live Away From Home	<10
Youth Will Get Paid Job	<10
Youth Will Support Self Financially	<10
Covariates	
Gender	<10
Income	<10
Ethnicity	<10
Age of Onset	<10

Because NLTS-2 provides individually-identifiable data, the percentages reported here are rounded to the nearest tens place in accordance with IES policy.

Due to the percentage of missing data in the parental expectations scale, 30 imputations were created with the Multivariate Imputation via Chained Equations (*mice*) package in *R* (cran.r-project.org) (van Buuren & Groothuis-Oudshoorn, 2011). Estimates were then pooled and combined by using the *pool(x)* function in *mice*. This function averages the estimates of the

complete data model and calculates total variance across the analyses using Rubin's rules (Rubin, 1987, p. 76; van Buuren, 2011). These results were then summarized.

Analysis of research questions. Mediation analysis was conducted with the *mediate* package in *R* (cran.r-project.org) (Sales, 2016; Tingley, D., Yamamoto, T., Hirose, K., Keele, K., & Imai, K. 2014). Prior to the mediation analysis, six different datasets were created in *R* – one for each dependent variable. As a refresher, merged datasets contained: the independent variable (average of depressive symptoms), the mediating variable (sum of parental expectations), the dependent variable (postsecondary outcomes) to reduce bias in case the missing data is related to the dependent variable, the survey weight, and the covariates (age of onset, gender, and income). Five multiple imputations were created for each dataset using *mice*, for a total of 30 datasets. These datasets were then placed into the mediation model for its respective dependent variable.

The first part of the analysis examined the linear relationship between the independent (depressive symptoms) variable and each dependent variable (postsecondary outcomes) while controlling for the covariates and survey weight. The formula used in R is as follows (family = binomial was added for binary outcomes):

```
OutcomeModel1 <- with(ImputedData, glm(Outcome~DepressiveSymptoms
        +Ethnicity+Gender+Income+AgeofOnset, family=binomial, weights =
        SurveyWeights)
```

In more accessible language, this formula means that to create Outcome Model 1, the data that was used (ImputedData) was the five imputed datasets that were created with multiple imputation as described above. Results were then pooled and summarized.

The second regression model examined the correlation between the independent (depressive symptoms) variable and the mediating variable (parent expectations) while

controlling for the study weight and covariates. The formula used in R is as follows (family = binomial was added for binary outcomes):

OutcomeModel2 <- with(ImputedData, glm(PeSUM~DepressiveSymptomsAverage +Ethnicity+Gender+Income+AgeofOnset, *family=binomial*, weights = SurveyWeights)

In more accessible language, this formula means that to create Outcome Model 2, the data that was used (ImputedData) was the five imputed datasets that were created with multiple imputation as described above. Results were then pooled and summarized.

The mediation analysis was then completed. The formula in R is as follows (family = binomial was added for binary outcomes).

mediate glm((ParentExpectations~DepressiveSymptoms+Ethnicity+Gender+Income +AgeofOnset,weights=(SurveyWeights)), glm(Outcome~DepressiveSymptoms +ParentExpectations+Ethnicity+Gender+Income+AgeofOnset, *family=binomial*, weights = (SurveyWeights)), treat="DepressiveSymptoms", mediator = "ParentExpectations"))

In more accessible language, this formula means that to create the mediation model, the data that was used (ImputedData) was the five imputed datasets that were created with multiple imputation as described above. In addition, the two models that were examined were 1) parent expectations regressed on depressive symptoms, the covariates, and the survey weight, and 2) the outcome regressed on depressive symptoms, parent expectations, the covariates, and the survey weight. Depressive symptoms was identified as the treatment (independent) variable, and the mediator was parent expectations. Data related to fit and estimates were then collected and averaged.

As a brief note, logistic regressions were employed for binary outcomes, and linear regression was used for continuous outcomes, similar to previous research that used NLTS-2 (Wehman, Chen, West, & Cifu, 2014). All of the coding used for this study can be found in Appendix K.

Chapter 4: Results

The purpose of this study is to examine the extent to which parental expectations mediate the relationship between depressive symptoms and postsecondary outcomes for youth with TBI. All statistical analyses were performed using R.

Main Analyses

Research question 1. This question inquired about the direct effect of depressive symptoms on postsecondary outcomes when controlling for the covariates. According to this analysis, depressive symptoms directly affected self-beliefs and whether the youth lived independently following high school. Based on these estimates, as depressive symptoms increase, self-beliefs (*Pooled Estimate* = -0.225, $p = 0.005$) and whether the youth lived independently following high school (*Pooled Estimate* = -1.95, $p < 0.001$) decreased. No other outcomes were significantly predicted by depressive symptoms. That is, depressive symptoms did not significantly predict a) whether a youth was ever employed (*Pooled Estimate* = -0.499, $p = 0.101$) b) youth's wages (*Pooled Estimate* = -0.545, $p = 0.674$, c) youth's job satisfaction (*Pooled Estimate* = -0.044, $p = 0.472$), and d) whether a youth graduated a postsecondary institution (*Pooled Estimate* = -0.223 $p = 0.489$). Please see Tables 3 and 4 for more information.

To help better explain why the results for some variables were not found to be significant, a sensitivity analysis was completed to determine the size of the effect that could have been detected given the sample size, power, and alpha, provided below. This analysis was conducted in G*Power (Faul, Erdfelder, Buchner, & Lang, 2009). Please see Table 5 for more information about this sensitivity analysis.

Table 3
Effect of Depressive Symptoms on Postsecondary Outcomes

DVs	*n**	*Pooled. Est.*	*Pooled. Std. Error*	*Pooled. p-value*
Employment				
Ever Employed	50	-0.499	0.296	0.101
Wages	40	-0.545	1.279	0.674
Job Satisfaction	40	-0.044	0.061	0.472
Academic				
Graduated Postsecondary Institution	40	0.223	0.322	0.489
Life				
Self-Beliefs	**50**	**-0.225**	**0.077**	**0.005**
Lived Independently	**60**	**-1.95**	**0.238**	**<0.001**

**Because NLTS-2 provides individually-identifiable data, the numbers reported here are rounded to the nearest tens place in accordance with IES policy.*

Table 4
Effect of Depressive Symptoms on Postsecondary Outcomes – Odds Ratios

DVs	*Pooled Odds Ratio Est.*	*Pooled Odds Ratio 95% CI*	
Employment			
Ever Employed	0.61	0.336	1.097
Academic			
Graduated Postsecondary Institution	1.25	0.656	2.379
Life			
Lived Independently	**0.14**	**0.088**	**0.229**

Table 5
Sensitivity Analysis

DVs	*N**	*Power*	*Alpha*	*Odds Ratio*
Employment				
Ever Employed	50	0.80	0.01	5.55
Wages	40	0.80	0.01	5.26
Job Satisfaction	40	0.80	0.01	5.26
Academic				
Graduated Postsecondary Institution	40	0.80	0.01	5.26
Life				
Self-Beliefs	50	0.80	0.01	5.55
Lived Independently	60	0.80	0.01	3.34

Based on these results, the odds ratios that these variables are powered to detect are over 5 (strong effect), with the exception of the Lived Independently variable, which is powered to detect a moderately-sized odds ratio (Ferguson, 2009). This is likely due to the higher sample size for the Lived Independently variable compared to the other variables of interest. As such, there is perhaps a meaningful effect within these variables, but the results are ambiguous due to them being underpowered.

Research question 2. This question inquired about the direct effect of depressive symptoms on parental expectations when controlling for the covariates. According to this analysis, depressive symptoms directly affected parental expectations for the participants who had the Lived Independently outcome reported. Based on these estimates, as depressive symptoms increased, parental expectations (*Pooled Estimate* = 4.41, p = 0.007) increased. Parental expectations within the other outcomes were not significantly predicted by depressive symptoms; these include a) whether the youth was employed (*Pooled Estimate* = 0.867, p = 0.531), b) youth's wages (*Pooled Estimate* = 0.516, p = 0.713), c) job satisfaction (*Pooled Estimate* = -0.114, p = 0.931), d) whether youth graduated from a postsecondary institution

(*Pooled Estimate* = 2.048, p = 0.098), and e) youth self-beliefs (*Pooled Estimate* = 0.59, p = 0.615). For more information, please see Tables 6 and 7.

Table 6
Effect of Depressive Symptoms on Parental Expectations

DVs	*N**	*Pooled. Est.*	*Pooled. Std. Error*	*Pooled. p-value*
Employment				
Ever Employed	50	0.867	1.372	0.531
Wages	40	0.516	1.391	0.713
Job Satisfaction	40	-0.114	1.299	0.931
Academic				
Graduated Postsecondary Institution	40	2.048	1.199	0.098
Life				
Self-Beliefs	50	0.59	1.179	0.615
Lived Independently	**60**	**4.41**	**1.408**	**0.007**

**Because NLTS-2 provides individually-identifiable data, the numbers reported here are rounded to the nearest tens place in accordance with IES policy.*

Table 7
Effect of Depressive Symptoms on Parental Expectations – Odds Ratios

DVs	*Pooled Odds Ratio Est.*	*Pooled Odds Ratio 95% CI*	
Employment			
Ever Employed	2.38	0.153	37.003
Academic			
Graduated Postsecondary Institution	7.75	0.705	85.285
Life			
Lived Independently	**82.27**	**4.923**	**1374.713**

As described in the above sensitivity analysis (Table 5), all variables with the exception of the Lived Independently outcome were powered to detect odds ratios over 5. The Lived Independently outcome was able to detect a moderate effect size (Ferguson, 2009). As such,

these insignificant results are likely due to these variables being underpowered, and results should be interpreted with a degree of caution.

It is also important to acknowledge that two of the reported odds ratios are quite high (Graduated Postsecondary Institution = 7.75; Lived Independently = 82.27), along with the confidence intervals. These inflated odds ratios and confidence intervals may be due to the relatively small sample sizes and these should be regarded with caution, as a large confidence interval typically indicates a low level of odds-ratio precision (Szumilas, 2010).

Table 8
Overall Mediation Outcomes

DVs	*Avg. Est.*	*Avg. Std. Error*	*Avg. 95% CI*		*Avg. p-value*
Employment					
Ever Employed	-0.001	0.015	-0.041	0.022	0.518
Wages	0.207	0.567	-0.869	1.499	0.688
Job Satisfaction	0.997	0.013	-0.027	0.032	0.997
Academic					
Graduated Postsecondary Institution	-0.038	0.025	-0.099	0.003	0.073
Life					
Self-Beliefs	0.009	0.022	-0.03	0.06	0.686
Lived Independently	**-0.063**	**0.023**	**-0.11**	**-0.02**	**0.002**

Research question 3. This question inquired about the mediating effect of parental expectations on the relationship between depressive symptoms and postsecondary outcomes when controlling for the covariates. According to this analysis, parental expectations significantly mediated the relationship between depressive symptoms and whether a youth lived independently (*Average Estimate* = -0.063, p = 0.002). Parental expectations did not significantly mediate the relationship between the other outcome variables of interest and

depressive symptoms. For more information, please see Table 8. For more information about the indirect effect, please see Appendix N.

Chapter 5: Discussion

Summary

Compared to children without a history of TBI, youth with TBI are more at-risk for depression and subsequent negative academic outcomes in postsecondary settings (Bockting, Hollon, Jarrett, Kuyken, & Dobson, 2008; Fann et al., 2003; Hibbard et al., 1998), though research regarding such relationships, as well as potential protective factors, is quite sparse. The purpose of this study was to examine the extent to which parent expectations mediate the relationship between depressive symptoms and postsecondary outcomes for youth with TBI. It is important to recall the longitudinal nature of this data collection; that the covariates were collected in Wave 1, the predictor variables in Wave 2 (two years after Wave 1), and the dependent variables in Wave 5 (ten years after Wave 1). Analyses included multiple regressions and tests of mediation using various packages (listed in the methods chapter) in *R.* The following sections will describe the results of this study and its limitations, offer directions for future research, and provide implications for clinical and school practice.

Effects of Depressive Symptoms of Postsecondary Outcomes. In this sample of youth with TBI, both of the Life Outcomes (self-beliefs and whether youth lived independently after high school) were significantly, negatively predicted by the presence of high depressive symptoms. This is relatively unsurprising, given the breadth of research that delineates the negative effects of depression across numerous life domains (Frojd, Nissinen, Pelkonen, Marttunen, Koivisto, and Kaltiala-Heino, 2008; Haines, Norris, & Kashy, 1996; Hembree, 1988; Hishinuma, McArdle, & Chang, 2012; Jaycox, Stein, Paddock, Miles, Chandra, Meredith, Tanielian, Hickey, and Burnam, 2009; Roeser, Eccles, & Sameroff, 2000; Speilberger, 2006). In addition, common symptoms of depression such as a sense of worthlessness and low self-esteem

are commensurate with the life outcomes yielded from this study (Kirkcaldy & Siefen, 1998; Kovacs & Goldston, 1991). It is important to note that this study relied on a one-time youth report of depressive symptoms, which was collected in Wave 2 when youth were between 14-18 years of age. Having a more empirically-based measure of assessing these symptoms, such as the BASC-3, would have allowed for a more data-driven diagnosis of depression (Kamphaus & Reynolds, 2015). This broadband measure essentially examines the question, "is this child displaying a higher-than-expected level of depression symptoms than their same-aged peers?" Levels of depression are categorized into three groups – within normal limits, subclinical (at-risk), or clinically significant. It is within these latter two groups that clinicians can identify a higher-than-usual prevalence of such symptoms (compared to their normative group) and formulate recommendations. On the BASC-3, validity indices are also in place to catch potential inconsistency, invalid responding, or "faking good" (Kamphaus & Reynolds, 2015). Such indices are not in place in this brief screener. It is possible that youth may have under-reported their depression or responded inconsistently. Despite this limitation, these results indicate that the relationship between depressive symptoms and general life outcomes for youth with TBI is a significant one, and that interventions aimed at ameliorating these symptoms may be beneficial to enhance postsecondary outcomes across all domains.

It is also important to consider why depressive symptoms were not significantly linked with academic and employment outcomes, as indicated by this study. The most likely reason is due to these variables being underpowered, as evidenced by the sensitivity analysis provided in the results section, as all outcomes (with the exception of Lived Independently) were powered to detect odds ratios over 5 (Ferguson, 2009). As such, a degree of ambiguity is present and results should therefore be interpreted with caution. While these variables are likely underpowered due

to a small effect size, it is also important to recall that youth with TBI were generally a small subset of the NLTS-2 dataset, and was further pared down because not all youth in this subtest met inclusion criteria for the study. As such, there may be meaningful effects, but these variables are underpowered to detect such relationships.

While the sensitivity analysis likely explains the majority of why significant relationships were not detected across all variables, it may still be important to consider other reasons why significant effects were not detected. For example, depressive symptoms are linked with lower academic performance (Reinherz, Giaconia, Pakiz, Silverman, Frost, & Lefkowitz, 1993; Shahar, Henrich, Winokur, Blatt, Kuperminc, & Leadbeater, 2006), though it may be that the neurocognitive effects of traumatic brain injury (e.g., difficulties with memory, executive functioning, and attention) have a stronger effect on students' academic than depression alone. However, the effect of both depressive symptoms and neurocognitive functioning on postsecondary outcomes cannot be ignored. In the literature, both of these variables have negative effects on academic outcomes (Favre, Hughes, Emslie, Stavinoha, Kennard, & Carmody, 2008; Fossati, Ergis, & Allilaire, 2002; Kirkcaldy & Siefen, 1998; Kovacs & Goldston, 1991; Reinherz, Giaconia, Pakiz, Silverman, Frost, & Lefkowitz, 1993; Shahar, Henrich, Winokur, Blatt, Kuperminc, & Leadbeater, 2006). While the present dataset did not have data on youth's neurocognitive functioning, it may be that a moderation effect exists between depressive symptoms and neurocognitive functioning as they predict academic postsecondary outcomes. Still, the risk of depression is higher in youth with TBI than those without a history, and it is imperative for schools to focus on both the neurocognitive deficits following a TBI and socio-emotional functioning in order to ameliorate the negative effects on academic outcomes.

For employment outcomes, it is first important to note that the variables of wages and job satisfaction assume that a youth is employed. The fact that depressive symptoms did not predict employment outcomes may be due to other factors not measured by the present study. For instance, a direct measure of injury severity was not reported within the dataset (e.g., the Glasgow Coma Scale), but the present study used the age-of-onset to serve as such a variable. Even when controlling for the age of onset, depression did not significantly predict employment outcomes. A potential reason for these findings is that the neurocognitive effects of TBI may have made obtaining their driving license difficult, or rendered them unfit to drive (Tamietto, M, Torrini, G., Adenzatio, M., Pietrapiana, Rago, R., & Perino, C., 2006). As such, this would make a youth's pursuit of an independent lifestyle, such as driving to-and-from their place of employment, nearly impossible. Certainly, it may have been possible that youth lived within walking distance of several potential employers, but proximity to work from either home or school was not collected as part of the dataset. In addition, while SES was collected as a covariate, there may also be the possibility that the youth's family did not have adequate resources to provide the youth with reliable transportation. In addition, the SES variable was only based on income and was provided to the researcher as a categorical variable – elements such as parental education, wealth, and occupation were not available. While in the literature, depression considerably effects attendance, productivity, and engagement (McTernan, Dollard, & LaMontagne, 2013), these results suggest that depressive symptoms alone may not be enough to predict employment outcomes amongst youth with TBI. It should be noted that the dataset did not include information about whether the youth received services to treat their depression (e.g., medication, therapy). Other protective factors such as friendships, parental attitudes towards mental health, and resilience were also not collected.

Effects of Depressive Symptoms on Parental Expectations. In this sample of youth, the relationship between depressive symptoms and parental expectations was significant amongst youth for whom the Lived Independently variable was reported (descriptives can be found in Appendix F). More narrowly, as depressive symptoms increased, parental expectations also increased. It should be noted, however, that it is likely that a reverse relationship exists between these variables. That is, extant research has shown that parental expectations may serve as a stressor for youth and lead to decreased mood, especially if youth feel as though such expectations cannot be met (Ang & Huan, 2006; Qin, 2008). As such, youth may suffer from decreased self-confidence and increased depression (2006). In addition, it is also important to interpret these results within the chosen sample – youth with TBI. Parents may lack information about neurocognitive effects of TBI and how they may manifest or change over time, and thus struggle to adjust their expectations. For example, if a youth did not experience difficulties with attention and completing work, but begin to show such symptoms following their TBI, their parents may maintain these higher expectations for their youth's ability to remain focused and complete their homework in a timely manner. These unrealistic expectations of their child may increase symptoms of unworthiness and exacerbate other symptoms of depression, placing their child at-risk for poor outcomes in several life domains, such as school, employment, and autonomy, especially as the youth transitions into postsecondary settings.

For the youth examined within the other outcomes of interest, significant relationships between depressive symptoms and parental expectations were not indicated. As noted earlier, this is likely due to limitations indicated by the sensitivity analysis, study design, and the availability of variables. As before, the variables were underpowered and therefore unable to detect meaningful effects, rendering the results somewhat ambiguous. These results should

therefore be interpreted with caution. Further expanding on some of the limitations, this current study summated the questions contained in the parent expectations variable without conducting various analyses at the item level (e.g., examining whether the Likert scale item "How likely is your child to live independently," is related to whether or not the youth lived independently), as such inquiries were beyond the scope of this current project. In addition, this model assumes that depressive symptoms preceded parent expectations. However, it is possible that in some cases, parental expectations were quite stable prior to the TBI, especially for youth for whom their TBI occurred later in life. Testing the model fit that places parental expectations as temporally before depressive symptoms may help provide more insight into how parental expectations are developed, maintained, or changed as the child matures, and whether this order is better suited for future research within NLTS-2. For this population in particular, it is thus posited that the parents' ability to *adjust* expectations may have more of an effect than the degree of expectations themselves, and future research may benefit from collecting pre-injury data to allow for subsequent analyses before-and-after the TBI to monitor such variables over time.

Mediating Effect of Parental Expectations. In this sample of youth, the mediating effect of parental expectations on the relationship between depressive symptoms and whether a youth Lived Independently was significant. From a statistical significance standpoint, this is unsurprising, as the previous models were also insignificant with the exception of the Lived Independently variable (Baron & Kenny, 1986). This result suggests that as depressive symptoms increase, a decrease in parental expectations mediates the relationship between depressive symptoms and whether a youth lives independently. This is slightly in conflict with previous research, which suggests that high parental expectations are associated with positive academic and life outcomes for the youth, such as academic performance, motivation, and

autonomy (Aldous, 2006; Bandura, Barbaranelli, Caprara, & Pastorelli, 1996; Davis-Kean, 2005; Fan & Williams, 2010; Lease & Dahlbeck, 2009; Pearce, 2006). However, as noted above, the ability for parents to *adjust* their expectations of their child following a TBI may be more predictive of their functioning than whether they are classified as "high" or "low." As such, given that the decrease in parental expectations yields the mediating effect, it is possible that these lower expectations are a product of adjusting the expectations of their child following the TBI, resulting in positive outcomes for the youth living independently.

While this model assumed that depressive symptoms precede both parental expectations and postsecondary outcomes, it is also noteworthy to mention that depression is typically a chronic mental health condition that requires lifelong treatment. It follows that events in a youth's life may alleviate or worsen such symptoms, one of which is the transition between living at home and living independently. This shift from adolescence to adulthood traditionally paves the way for the development of autonomy, and enrollment in a postsecondary institution is typically the first time youth will not reside in the same home as their parents. Youth therefore begin making their own social, financial, academic, and life decisions with decreased familial support or input. At this point in time, it is also important for parents to gradually relinquish control to help facilitate autonomy, which may be difficult for parents with medically complex children. Of note, there are numerous emotional outcomes associated with living independently, such as feeling fulfilled, having little dependence on others, and having control over one's life (Frieden et all., 1979). Such disruptions to their progress towards living independently may reduce their feelings of autonomy or make them feel empty, thereby exacerbating already existing symptoms of depression. As such, while it is important to treat depression for these

youth, it is also important for parents, teachers, counselors, and youth to consider how the achievement (or not) of various outcomes can affect emotional or behavioral functioning.

Limitations

There are several limitations to consider in this study. First, it is important to note that there is limited generalizability of these findings, as the sample size of the entire TBI population in NLTS-2 was smaller compared to those representing other disabilities. While this is intended to represent the proportion of youth identified as needing special education services secondary to TBI, these youth may represent a sample with more severe TBI (i.e., there may be other youth who sustained a TBI but did not require special education services). As such, the results of this study should be considered in the context of a more severe patient population and may not be representative of the outcomes for all youth with a TBI.

Another limitation was that of the study variables. The current study utilized an existing dataset, with information collected from parents, youth, schools, and teachers. The use of a such a dataset is limited in and of itself, as it prevents the researcher from inserting variables they may find germane to their research questions. For example, there was not a variable specifically designated as "injury severity" (e.g., Glasgow Coma Scale score), but the Age of Onset variable was utilized to account for potential severity and long-lasting effects of TBI, given that prognoses are poorer when a youth sustains a TBI at a younger age than at an older (Faul, Xu, Wald, & Coronado, 2010; US Department of Health and Human Services, 1998). Other information that may have been useful for the current study were not collected, namely hospital data such as cause of head injury, length of stay in the hospital, receipt of physical/occupational/speech therapy, neuropsychological testing, or psychological functioning while in the hospital. The provision of this information would have allowed for a more nuanced

description of the sample, and a richer analysis of TBI variables that could contribute to various outcomes. More research is also needed to determine how to quantify such variables to examine their relationship with postsecondary and psychosocial outcomes.

For the depressive symptoms variable, this study was also limited in that this variable was obtained from responses to a brief depression screener. That is, psychometrically valid screening instruments to aid in diagnostic impressions, such as the BASC-3 (Kamphaus & Reynolds, 2015), were not utilized. As such, it was not possible to identify the presence of a depressive disorder in youth with a TBI, which limits the conclusions one can draw from this study over time. For example, youth may have reported increased depressive symptoms on the screener due to adjustment difficulties to their TBI, or an unrelated, transient event in their lives.

Parental expectations at the item-level were not examined as this was beyond the purpose of this study, but it is important to acknowledge that the averaging of parents' responses to items reduced response variability, which may have been an important facet of the data to consider for more direct analyses of how *specific* parental expectations affect outcomes. Furthermore, parental expectations is a piece of how parenting affects youth outcomes. This study did not include other measures, such as parental involvement or parental behaviors, that could influence parental expectations.

Additionally, the dataset was collected over a period of ten years, which limits the extent to which this study can draw conclusions of changes over time, as data from Waves 3 and 4 were not included in analyses. That is, the data collected for the depressive symptoms and parental expectations variables were collected in Wave 2, then the postsecondary data was collected six years later in Wave 5. This leaves approximately four years in between the times in which these data were collected. It is possible that several artifacts that could not be controlled influenced the

postsecondary outcomes during those four years (e.g., life events, financial emergencies, accidents, deaths, moving houses). While the study attempted to control for as many variables as possible, events outside of the data collection during this large temporal gap may have influenced the postsecondary outcomes. Another limitation is that this study did not include a control group.

The longitudinal nature of this dataset also is limited in several ways. One of the primary limitations of this type of data collection is attrition. As noted earlier, data was collected over a period of ten years. While 450 students were identified at the commencement of data collection (Wave 1), only 40-60 of these students had data at the end of Wave 5 (these numbers are rounded to the nearest tens place). According to NLTS-2, researchers attempted many ways to remain in contact with families, such as contacting them over the phone, or by mail, but some participants stopped responding or decided they did not want to be included in the study. In addition, the method of data collection was intensive and time-consuming - parent and youth surveys were often several pages long. Such a process increases opportunities for missing data, which was quite prevalent for several items analyzed in this research. While the current study used Multiple Imputation and ran analyses on these imputed datasets, the presence of missing data is a limitation to be acknowledged.

Finally, the number of youth included within each outcome of interest varied due to missing data and attrition, as youth information was excluded from the study if they did not have reported outcome variables (as multiple imputation is not appropriate). This may limit the extent to which this research can generalize across the TBI population, as different youth were analyzed for each outcome. Descriptives are provided in the appendices (Appendix B-F) for review.

Recommendations for Future Research

Those interested in pursuing further research should address the above limitations. The inclusion of medical data (e.g., length of hospital stay, injury severity) might be helpful to identify the characteristics of the TBI itself that are associated with postsecondary or psychosocial outcomes. One of the key takeaways from this study is that more collaboration between schools and hospitals is necessary to promote optimal outcomes for medically complex youth as they navigate through school, especially as it relates to research. Having a full neuropsychological evaluation completed at the hospital and shared with the school can fulfill both the collection of medical variables germane for future research while also providing the school with evidence for a youth's need of special education or 504 services.

For the measurement, depressive symptoms were calculated from a brief depression screener. To address this limitation, a more in-depth, valid screener such as the BASC-3 would be useful to identify whether further inquiry into youth's depressive symptoms are warranted. If so, it would also be important to use psychometrically-sound instruments (e.g., CDI-2) or semi-structured interviews (e.g., K-SADS) for future research. In addition, while NLTS-2 collected data from several sources, researchers did not collect emotional or behavioral data of the youth from the teacher's perspective. Future research should provide rating scales to multiple informants (e.g., doctor, parent, youth, teacher) to ascertain whether findings are consistent across settings and to aid in treatment or academic planning. For the parental expectations variable, it would also be helpful for researchers to collect information about parenting behaviors, psychopathology, or coping affects their expectations of their child.

Future research may also benefit from examining differences amongst youth who qualify for special education services under primary or secondary eligibilities, as the presence of

multiple disabilities may contribute to parental expectations of their child's postsecondary outcomes. For example, a youth may be mobility-impaired following a TBI and thus receive services under Physical Impairment and TBI, with the Physical Impairment reflecting more of their depressive symptoms, parents' expectations, or postsecondary outcomes than the TBI itself.

Implications for Clinical Practice

Living independently is generally considered an important step in the transition to adulthood. The ability to live independently has well-documented, positive effects on individuals' quality of life, especially so for those with disabilities. According to Frieden et al., 1979, independent living includes the following: 1) fulfilling social roles, 2) having control over one's life, 3) and having little dependence on others for completing daily routines, tasks, or activities. Young adults living independently become responsible for many other decisions, such as financial matters, managing their time, and establishment of social relationships. That depression significantly and negatively predicted whether a youth lived independently, as indicated by the present study, suggests that one's readiness to live independently is affected by both TBI and depression. For example, depending on the severity of the injury, some youth may still depend on their parents for transportation, to help them complete their schoolwork, make doctor appointments, or make financial decisions. Youth who are depressed may be less motivated than their peers to make such strides, or feel generally hopeless about their prospects. While the current study employed binary data for whether or not youth lived independently following high school, it will be important for those involved with the care of youth with TBI to take a closer look at the specific factors that indicate readiness for independent living. That is, a youth may be able to handle their own finances and complete school work with designated accommodations, but may be unable to operate a vehicle. Specific inquiry into how to prepare

youth with TBI for independent living will be beneficial, with the acknowledgment that readiness and the speed of progress towards such goals may look vastly different for each individual.

Per year, approximately 500,000 children aged 0-14 in the United States present to the emergency room as a result of TBI (Faul, Xu, Wald, & Coronado, 2010). Some leading causes of TBI are participation in contact sports or motor vehicle accidents, both of which are activities in which most youth partake during school years (e.g., joining the football team, getting their driver's license). As such, youth are perpetually at-risk for such injuries. While the effects of a TBI vary depending on several factors, neurocognitive effects are especially concerning for youth since their brains develop into early adulthood. In addition, youth spend the majority of their time in school, where such neurocognitive effects can negatively impact their social life, academics, or behavior. While school psychology evaluations are focused primarily on determining eligibility for services, neuropsychology evaluations expand on this by examining functional deficits associated with a particular medical condition or presenting concern. School psychology training for neuropsychologists can help them determine eligibility for services without the need for a school-based diagnostician, thus streamlining the assessment and research process. As such, one of the main takeaways is the need for increased collaboration between schools and medical settings to improve outcomes for these youth, as well as support researchers interested in bridging the gap between schools and hospitals.

Neuropsychologists and other clinicians who work with this population should ensure that they make a connection with their patient's school to support in treatment and academic planning. The sharing of data between these settings may also allow for a smooth delivery of interventions or accommodations – the neuropsychologist or patient representative could be part

of the ARD meeting at the school to help advocate for the child's services. In addition, this will allow for researchers interested in academic outcomes for youth with TBI to have one place to collect data (e.g., the school) rather than numerous settings which may not have a relationship.

In addition, teachers, parents, neuropsychologists, or clinicians should be aware of the higher rates of depression within this population. While the brief depression screener was limited for research purposes, consistent screening procedures should be used in the hospital or at school to ensure that youth with a TBI with co-occurring emotional complications are identified and provided adequate intervention or services. In addition, while the present study did not indicate significant relationships between depression and postsecondary outcomes exist for employment outcomes for this sample of youth, it should still be noted that depression has well-documented negative effects on one's ability to work, and is still the leading cause of disability worldwide (Lerner, Adler, Rogers, Chang, Lapitsky, McLaughlin, & Reed, 2014; WHO, 2001). Given the higher risk of depression for youth with TBI than those without, consistent and intensive support for finding and maintaining employment should be provided. This could look like programs at school or at the hospital that teaches youth how to advocate for accommodations in the workplace or determine whether they are ready for a job – thus facilitating their independence and allowing them to take more control over such decisions. The implementation of such programs, coupled with comprehensive support from those involved in the youth's care, can help promote positive outcomes as these youth transition into late-adolescence, early adulthood, and beyond.

Implications for IEP/Transition Planning

As described in the literature review, disabled youth in grades Kindergarten through 12th grade are eligible for services under the Individuals with Disabilities Education Act (IDEA). TBI

itself is an eligibility category for services due to the emergence of neurocognitive effects (e.g., decreased attention or memory) and their effect on academic functioning. Students receive services through a 504 Plan or an Individualized Education Plan (IEP), both of which are collaboratively created by the student, parents, administrators, and teachers. Services may include accommodations (e.g., extra time on class work or tests, preferential seating towards the front of the classroom) or intervention (e.g., pull-out services for reading) if the student qualifies for special education. For the purposes of this study, students were identified as having a TBI as one of their disability categories for special education.

Given the results of this study, it is clear that the relationship between depressive symptoms, parental expectations, and postsecondary outcomes is complex. In addition, it is generally understood that parents want the best outcomes for their children, though achieving such positive outcomes requires early and consistent attention to a child's needs, strengths, and difficulties. As noted earlier, this study did not investigate the presence of absence of specific parental behaviors, but one in particular is worth mentioning – parental involvement. Due to the collaborative nature of IEP or 504 Plans, parent involvement at school may not only help set their child up for success in the short-term, but it has also been found to positively affect children's decision-making and college-planning (Tierney & Auerbach, 2005). Both of these skills are necessary to access to postsecondary education and generally develop in high school (King, 2008). As such, for youth with TBI, one of the main implications for IEP/504 planning is to try and involve the parent at all levels of eligibility determination and service delivery. As part of a team, parents may feel as though their voice is important and they may also learn directly from the teachers about their child's progress in school and how it may have changed following the TBI. This may allow parents to empower themselves by helping their child advocate for

themselves, as well as to ensure that the child is receiving appropriate and comprehensive services to help level the playing field. The establishment of such a strong foundation will likely provide the child with a space to perform at their highest ability, ensure access to education, and allow them to share their knowledge in a way that is conducive to their current strengths. Like parents, teachers should also be flexible in their expectations of the child and exercise compassion to both the child and his or her family as they navigate life following a TBI.

To extend on the 504/IEPs, after a youth completes high school, they are typically no longer protected under IDEA. Transition programs that support students aging out of IDEA to the Americans with Disabilities Act (ADA) have minimum federal requirements, though specialized evidence-based programs are in place for youth with TBI (Hayes, Sublette, Harwick & Hood, 2012). The five categories of one such *Transition Toolkit for Students with Traumatic Brain Injury* are a) student-focused planning, b) student development, c) interagency collaboration, d) family involvement, and e) program structures (2012). Such areas of emphasis are crucial for students as they gradually become responsible for advocating and maintaining their accommodations in postsecondary institutions. In contrast with the accessibility processes during their elementary and secondary school years, where schools are legally obligated each year to determine a student's eligibility for services with teachers, parents, and administrators involved, college students are responsible for requesting their services, providing relevant documentation, self-disclosing their disability to the university, interacting with faculty, and advocating for themselves within the postsecondary setting. As noted earlier, the transition plan emphasizes the role of family involvement and student development in building positive traits in the student, encouraging collaboration between agencies, and fostering independence. These responsibilities, coupled with the youth's course load, present a unique, often overwhelming set

of challenges (Getzel & Thomas, 2008). Despite these difficulties, the accommodations listed in a student's transition or postsecondary education plan are oftentimes essential for equal access to course material as well as fair opportunities to demonstrate their knowledge (e.g., permission to take exams in a reduced distraction environment, access to a student note-taker).

While much of this section has focused on the transition from secondary to postsecondary education, it is also important to discuss vocational rehabilitation (VR) services for individuals affected by a TBI. Briefly, eligibility for VR services are determined by three criteria: a) the individual must have an emotional, physical, mental, or learning disability that is a barrier to obtaining gainful employment, b) individuals must need VR services to aid with job obtainment and maintenance, and c) must benefit from services or from independent living. Oftentimes, VR services are informed by goals that are documented in a youth's IEP. As before, establishing VR services requires intensive collaboration from many involved parties (e.g., the VR agencies, parents, the child). VR would also assess independent living needs and help determine whether a youth is able to both live independently and maintain employment. Given the results of this evaluation, awareness and education about VR services may encourage parents and their children to apply early for services, as well as to understand that the neurocognitive effects of TBI may affect both the child's ability to learn and to perform at work. It is the hope of this study that parents realize not only the risk-factors of TBI across several domains, but how their expectations, involvement, and flexibility can be protective factors.

Conclusion

The presence of depression in youth with TBI is quite complex, and is affected by numerous factors at the biological, individual, family, school, and environmental levels. Understanding how family factors affect depression and postsecondary outcomes is an area of

developing research for youth with TBI. This current study indicated that depressive symptoms negatively predicted whether youth with TBI lived independently, which in and of itself plays an important role in the development of age-appropriate autonomy, independence, and feelings of fulfillment. Parent expectations were also found to mediate the relationship between depressive symptoms and whether a youth lived independently, suggesting that a parent's ability to adjust expectations following their child's TBI may produce more positive outcomes than whether they are high or low. While more research is needed to better understand how specific characteristics of the TBI affect depressive symptoms and parental expectations, as well as to better clarify the temporal precedence of depressive symptoms and parental expectations, all who work with youth with TBI should be aware of *both* the emotional and neurocognitive consequences of TBI, and ensure that the youth receives comprehensive services to aid in developing appropriate treatment and academic planning.

Appendices

Appendix A
Depressive Symptoms Items

Item	*Scale*
How often youth felt the following in the last week:	
Enjoyed Life	Likert 1-4
Depressed	Likert 1-4
That People Disliked You	Likert 1-4
Hopeful about the Future	Likert 1-4
Lonely	Likert 1-4

Appendix B
Parent Expectations Items

Item	*Scale*
Likelihood that youth will:	
Get a regular high school diploma	Likert 1-4
Attend postsecondary school	Likert 1-4
Complete a vocational or technical program	Likert 1-4
Graduate from a 2-year/community college	Likert 1-4
Graduate from a 4-year college	Likert 1-4
Get a driver's license	Likert 1-4
Live away from home without supervision	Likert 1-4
Live away from home with supervision	Likert 1-4
Eventually get a paid job	Likert 1-4
Earn enough to support self without financial help	Likert 1-4

Appendix C
Self-Beliefs Items

Item	*Scale*
Youth's identification with the following statements:	
You are proud of who you are	Likert 1-3
You feel useful and important	Likert 1-3
You know how to get the information you need	Likert 1-3
You feel your life is full of interesting things to do	Likert 1-3
You can handle most things that come your way	Likert 1-3

Appendix D
Job Satisfaction Items

Item	*Scale*
Youth thinks he/she has opportunities to work his/her way up	Binary
Youth thinks he/she is paid pretty well for his/her work	Binary
Youth thinks he/she is treated pretty well by others at work	Binary
Youth thinks his/her education is being put to good use	Binary
How well youth gets along with coworkers at current job	Likert 1-4
How well youth gets along with boss at current job	Likert 1-4
How well youth usually likes his/her current job	Likert 1-4

Appendix E
Participant Demographics

N	*450**
Average Age of Injury (years)	*6.60*
Variable	*Weighted Percentage*
Male	70
Age (as of 2002; Wave 1)	
14	10
15	30
16	30
17	30
18	<10
Ethnicity	
White	60
African American	20
Hispanic	10
Asian/Pacific Islander	<10
American Indian/Alaska Native	<10
Other/Multiple	<10
Family Income	
$25,000 or less	30
$25,001 - $50,000	30
More than $50,000	40

**Because NLTS-2 provides individually-identifiable data, the number of participants and the percentages reported here are rounded to the nearest tens place in accordance with IES policy.*

Appendix F

Demographics for Academic Outcome Covariates

Variable	*Weighted Percentage*
Male	60
Age (as of 2002; Wave 1)	
14	10
15	50
16	40
Ethnicity	
White	80
African American	10
Hispanic	10
American Indian/Alaska Native	<10
Income	
$25,000 or less	20
$25,001 - $50,000	30
More than $50,000	50
Average Age of Injury (years)	6.73

Because NLTS-2 provides individually-identifiable data, the percentages reported here are rounded to the nearest tens place in accordance with IES policy.

Appendix G

Employment (Ever Employed) Outcome Covariates

Variable	*Weighted Percentage*
Male	60
Age (as of 2002; Wave 1)	
14	20
15	40
16	40
Ethnicity	
White	70
African American	10
Hispanic	10
American Indian/Alaska Native	<10
Income	
$25,000 or less	30
$25,001 - $50,000	30
More than $50,000	40
Average Age of Injury (years)	5.93

Because NLTS-2 provides individually-identifiable data, the percentages reported here are rounded to the nearest tens place in accordance with IES policy.

Appendix H

Employment Outcome (Job Earnings and Job Satisfaction) Outcome Covariates

Variable	*Weighted Percentage*
Male	70
Age (as of 2002; Wave 1)	
14	20
15	40
16	40
Ethnicity	
White	70
African American	20
Hispanic	<10
American Indian/Alaska Native	<10
Income	
$25,000 or less	30
$25,001 - $50,000	30
More than $50,000	40
Average Age of Injury (years)	6.59

Because NLTS-2 provides individually-identifiable data, the percentages reported here are rounded to the nearest tens place in accordance with IES policy.

Appendix I
Life Outcome (Self-Beliefs) Covariates

Variable	*Weighted Percentage*
Male	60
Age (as of 2002; Wave 1)	
14	20
15	40
16	40
Ethnicity	
White	70
African American	20
Hispanic	<10
American Indian/Alaska Native	<10
Income	
$25,000 or less	30
$25,001 - $50,000	20
More than $50,000	40
Average Age of Injury (years)	5.97

Because NLTS-2 provides individually-identifiable data, the percentages reported here are rounded to the nearest tens place in accordance with IES policy.

Appendix J

Life Outcome (Live Independently) Covariates

Variable	*Weighted Percentage*
Male	70
Age (as of 2002; Wave 1)	
14	20
15	40
16	40
Ethnicity	
White	80
African American	10
Hispanic	<10
American Indian/Alaska Native	<10
Income	
$25,000 or less	20
$25,001 - $50,000	30
More than $50,000	50
Average Age of Injury (years)	5.92

Because NLTS-2 provides individually-identifiable data, the percentages reported here are rounded to the nearest tens place in accordance with IES policy.

Appendix K

```
#coding for R

#cleaning the data for only youth with TBI, and getting the covariates

    TBIdataset <- subset(NLTS2Wave1$Disability, NLTS2Wave1$AgeofOnset,

        NLTS2Wave1$Ethnicity, NLTS2Wave1$Gender, NLTS2Wave1$Income)

#cleaning the outcome data – the coding is the same across all six outcomes. X is equal to the germane column number that contains the outcome variable of interest (e.g., whether youth lived independently). Column 1 is the youth's ID number.

    OutcomeDataforAnalysis <- subset(NLTS2Wave5, select=c(1,x)

#adding the depressive symptoms variable

    TBIDepressive <- merge(TBIdataset, DepressiveWave2, by ="ID")

#adding the parental expectations variable

    TBIDepressivePE <- merge(TBIDepressive, ParentExpectationsWave2, by="ID")

#summing parental expectations variable (same process for depressive symptoms)

    TBIDepressivePE$PESum <- sum(TBIDepressivePE$question1,

        TBIDepressivePE$question2...)

#adding survey weights

    FinalDataset <- merge(TBIDepressive, NLTS2Wave5$Wt_Any, b ="ID")

#missing data summary

    colMeans(is.na(TBIDepressivePE))

#multiple imputation for the dataset

    library(mediation)

    ImputedData <- mice(FinalDataset, m=5, maxit=5-, seed=500)

    Long <- mice::complete(ImputedData, "long", include= "TRUE")

    Long$PESUM <- with(Long, c1+c2+c3...)
```

```
ImputethenTrans <- as.mids(Long)

MIwithImputed <- complete(ImputethenTrans)

#completing the regression models for each outcome. The coding is the same for each dependent variable. Family=binomial was added for the variables with binary outcomes.

OutcomeModel1 <- with(ImputethenTrans, glm(Outcome~DepressiveSymptomsAverage
    +Ethnicity+Gender+Income+AgeofOnset, family=binomial, weights =
    SurveyWeights)

OutcomeModel1Pool <- pool(OutcomeModel1)

summary(OutcomeModel1Pool)

OutcomeModel2 <- with(ImputethenTrans, glm(PeSUM~DepressiveSymptomsAverage
    +Ethnicity+Gender+Income+AgeofOnset, family=binomial, weights =
    SurveyWeights)

OutcomeModel2Pool <-pool(OutcomeModel2)

summary(OutcomeModel2Pool)

#how mediation was completed

MediationData <-  with(ImputethenTrans,
    mediate (lm(PESUM~DepressiveSymptomsAverage+Ethnicit+Gender+Income
    +AgeofOnset,weights=(SurveyWeights)), glm(Outcome~DepressiveSymptoms
    Average+PESUM+Ethnicity+Gender+Income+AgeofOnset, family=binomial,
    weights = (SurveyWeights)), treat="DepressiveSymptomsAverage", mediator
    = "PESUM"))

#obtaining fit and estimates

MediationDataFit <- getfit(MediationData)

summary(MediationDataFit)

d.avg.sims <- c(
    MediationDataFit[[1]]$d.avg.sims,
```

```
            MediationDataFit[[2]]$d.avg.sims,
            MediationDataFit[[3]]$d.avg.sims,
            MediationDataFit[[4]]$d.avg.sims,
            MediationDataFit[[5]]$d.avg.sims,)
        d.avg.est
            MediationDataFit=mean(d.avg.sims.MediationDataFit))
        d.avg.ci
            MediationDataFit=quantile(d.avg.sims.MediationDataFit, c(0.025, 0.975))
        d.avg.se
            MediationDataFit=sd(d.avg.sims.MediationDataFit)
        d.avg.p
            MediationDataFit=2*min(mean(d.avg.sims.MediationDataFit<0), mean(d.avg.
                sims>0.MediationDataFit)
#for calculation of odds ratios
        exp(pooledestimate)
#for calculation of odds ratios confidence intervals
        exp(pooledestimate – 2*standarderror), exp(est + 2*standarderror)
```

Appendix L

Effect of Depressive Symptoms on Postsecondary Outcomes – Pooled Regression Coefficients

DVs	*n****	*Int.*	*Dep.*	*AA*	*His.*	*AI/AN*	*Fem.*	*IG2*	*IG3*	*AgeOfOn*
Employment										
Ever Emp.	50	4.86*	-0.49	0.09	0.23	-19.3	-0.85**	-0.78	-2.14*	-0.03
Wages	40	22.3**	-0.54	-2.19	1.34	-	-0.11	-8.81**	-3.48	-0.55*
Job Satis.	40	0.79**	-0.04	0.32*	0.03	-	0.15*	-0.17	0.29*	-0.02
Academic										
Grad	40	-0.36*	-0.14	-1.02*	0.07	-12.09	-0.95*	-3.22*	-2.06	-0.04
Life										
Self-Bel.	50	3.53**	-0.22	-0.29	-0.23	0.29	-0.09	-0.35*	-0.27	-0.02*
Live Ind.	60	-0.02	-1.95**	-1.32	1.70**	14.1	1.59**	1.75**	1.08*	0.18**

**p <0.05 **p<0.01*

****Because NLTS-2 provides individually-identifiable data, the numbers reported here are rounded to the nearest tens place in accordance with IES policy.*

Int = Intercept; Dep = Depressive Symptoms Average; AA = African American; His = Hispanic; AI/AN = American Indian/Alaska Native; Fem. = Female; IG2/3 = Income Groups 2 and 3; AgeOfOn = Age of Onset

Appendix M

Effect of Depressive Symptoms on Parent Expectations – Pooled Regression Coefficients

DVs	*n****	*Int.*	*Dep.*	*AA*	*His.*	*AI/AN*	*Fem.*	*IG2*	*IG3*	*AgeOfOn*
Employment										
Ever Emp.	50	19.5**	0.87	-4.73	-0.92	7.48	0.01	-6.34*	-3.87	-0.52
Wages	40	7.09	0.51	1.78	0.38	-	-2.13	3.00	1.86	0.03
Job Satis.	40	20.1**	-0.11	-2.07	1.40	-	-.28	-7.59	-2.14	-0.50
Academic										
Grad	40	4.01	0.68	-0.98	0.55	6.91	-0.35	2.23	1.99	-0.23
Life										
Self-Bel.	50	19.54**	0.59	-4.42	-0.53	5.54	0.42	-6.70	-4.15	-0.44
Live Ind.	60	11.6	4.14**	-2.28	-5.72	4.09	0.27	-1.99*	-2.64	-0.43*

**p <0.05 **p<0.01*

****Because NLTS-2 provides individually-identifiable data, the numbers reported here are rounded to the nearest tens place in accordance with IES policy.*

Int = Intercept; Dep = Depressive Symptoms Average; AA = African American; His = Hispanic; AI/AN = American Indian/Alaska Native; Fem. = Female; IG2/3 = Income Groups 2 and 3; AgeOfOn = Age of Onset

Appendix N

Effect of Parent Expectations on Outcomes – Pooled Regression Coefficients

DVs	*n****	*Int.*	*Dep.*	*PE.*	*AA*	*His.*	*AI/A*	*Fem.*	*IG2*	*IG3*	*AgeOfOn*
Employment											
Ever Emp.	50	8.74**	-0.48	-0.14	-0.87	-0.08	-18.3	-0.97	-2.01	-3.39**	-0.15*
Wages	40	16.5**	0.29	-0.42	0.83	0.94	-	-2.12	-0.72	0.38	0.19
Job Satis.	40	0.75*	-0.04	0.02	0.33	0.02	-	0.15*	-0.16	0.28*	-0.01
Academic											
Grad	40	4.51**	-0.55	-0.11	0.29	-0.57	-15.5	1.56*	-0.33	0.41*	0.17
Life											
Self-Bel.	50	3.24**	-0.23**	0.01	-0.23	-0.22	0.21	-0.09	-0.26	-0.21	-0.02
Live Ind.	60	2.39*	-1.55**	-0.17**	-2.01*	1.02	14.6	1.93**	1.05	0.57	0.13**

**p <0.05 **p<0.01*

****Because NLTS-2 provides individually-identifiable data, the numbers reported here are rounded to the nearest tens place in accordance with IES policy.*

Int = Intercept; Dep = Depressive Symptoms Average; PE = Parent Expectations; AA = African American; His = Hispanic; AI/AN = American Indian/Alaska Native; Fem. = Female; IG2/3 = Income Groups 2 and 3; AgeOfOn = Age of Onset

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